The frequency-domain signals are weighted for calculating the path-metrics in the soft-decision Viterbi decoder, and the optimal weights are determined by the corresponding SNR.

The resulting SNR for the combined signal becomes:

5
$$SNR = \sum_{j \in S_c} |H_j|^2 \frac{E_x}{\sigma_j^2}$$

where E_x is the signal power, and σ_j^2 is the noise power for the subchannel j. The combined SNR is used to evaluate the Viterbi weights.

The 802.11a/g standard specifies that there are four pilot signals included in each OFDM symbol for the purpose of estimating timing offset and frequency offset and

10   tracking phase noise in 802.11a/g signals. The 802.11a/g system assumes that these 4 pilots are reliable enough to estimate the phase information. That assumption may not be true for a system with a very low SNR. The redundancy that exists in the frequency-domain signal is exploited to help the pilots to estimate and track phase.

The phase information is estimated from the frequency domain data as follows:

15   1. The repeated signals are combined in the frequency domain to increase the SNR, with a channel estimate determined from a preamble sequence of long symbols and an estimated slope, which captures the effect of timing offset.

2. Hard decisions are made for each of the combined signals after removing the phase offset estimated from the previous symbol.

3. The combined signals are multiplied by their own hard decisions. The average of the hard-decision corrected signal is used to evaluate an angle to estimate the phase

5   offset for the current symbol.

A filter is applied to the estimated phase offset to reduce the effect of noise. In one embodiment, a nonlinear median filter is used. The nonlinear median filter effectively detects and corrects an abrupt change in the phase offset, which could be caused by hard decision errors.

10   An encoding and decoding scheme for a wireless system has been disclosed. Preferably, repetition coding in the frequency domain is used. An interleaver that provides frequency diversity has been described. In various embodiments, the described techniques may be combined or used separately according to specific system requirements.

15   Although the foregoing invention has been described in some detail for purposes of clarity of understanding, it will be apparent that certain changes and modifications may be practiced within the scope of the appended claims. It should be noted that there are many alternative ways of implementing both the process and apparatus of the present invention. Accordingly, the present embodiments are to be considered as illustrative and

20   not restrictive, and the invention is not to be limited to the details given herein, but may be modified within the scope and equivalents of the appended claims.